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Case Report

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Management of surgical treatment with autogenous graft for papilla reconstruction in cases of peri-implant papilla loss: 3-month follow-up

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ABSTRACT

The interdental papilla is a crucial structure of the gingiva, and its height may decrease or be completely lost due to various factors. This loss often results in an open embrasure space commonly referred to as a "black triangle." Black triangles are aesthetically displeasing and frequently a cause of patient complaints. Understanding the available treatment methods for addressing this condition is vital for clinicians. A 43-year-old female patient presented to our clinic with complaints of black triangle spaces caused by papilla loss in the region of implant #13. Evaluations revealed a reduction in the papilla height in the mesial and distal areas of the peri-implant region, with no evidence of peri-implant mucositis or peri-implantitis. After obtaining informed consent, an autogenous soft tissue graft was harvested from the patient's palatal region during the same session and placed at the recipient site. The healing process was monitored postoperatively.

Keywords: Interdental papilla loss, papilla reconstruction, autogenous graft, de-epithelialized FGG

INTRODUCTION

The interdental papilla is the gingival tissue that fills the embrasure space located between the contact points of adjacent teeth. Its structural integrity is maintained through support derived from the boundaries of the underlying alveolar bone and the surrounding teeth.[1] Composed of masticatory mucosa, this structure has a dense connective tissue composition and is covered with oral epithelium (non-keratinized stratified squamous epithelium).[2] The shape of the interdental papilla is determined by the contact points between adjacent teeth, the width of the interproximal tooth surfaces, and the contour of the cementoenamel junction (CEJ). While the interdental papilla exhibits a pyramidal form in anterior teeth, in posterior regions, it appears as two papillae connected by a concave saddle-shaped structure called the "col" region. The col structure may exhibit parakeratinized or non-keratinized tissue characteristics.[3] Papillary height gradually decreases as one moves from anterior to posterior regions, with the interproximal contact area reaching its highest level between the central incisors.

Conversely, the width of the col region increases as it progresses along the arch. The interdental papilla plays a significant role in shaping the scalloped contour of the gingival margin. Initially, the interdental papilla was thought to serve solely the function of "removing food debris." However, it was later suggested that the interdental papilla could also function as a barrier and defense mechanism by protecting the underlying periodontal tissues.[3] Upon examining samples taken from dental students, "round cell infiltration" was identified within the interdental papillae. This inflammatory cell infiltrate is believed to represent a defensive response to continuous bacterial invasion, resulting from the accumulation of dental plaque.

The presence of the interdental papilla also plays a crucial role in aesthetics. A clinical study conducted by Tarnow et al.[4] investigated the relationship between the distance from the most coronal point of the interdental bone crest to the apical edge of the contact point between teeth and the presence or absence of the interdental papilla.

This study included a large sample of 288 interdental sites from 30 randomly selected patients. The results revealed that as the distance (measured in millimeters) from the contact point to the bone crest increased, the likelihood of the presence of the interdental papilla decreased. When the distance was 3-4 mm, a complete interdental papilla was present in all sites (100%). At 5 mm, the papilla was observed in 98% of the sites. However, when the distance reached 6 mm or more, partial or complete absence of the interdental papilla was noted. With each millimeter increase, the probability of papilla presence significantly declined. The study concluded that the height of the interdental papilla is determined by the vertical height of the underlying bone.

Joshi et al.[5] conducted a cross-sectional study involving 150 interdental sites across 30 patients to evaluate the factors

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influencing interdental papilla fill. According to the study's findings, when the crown width-to-length ratio exceeded 0.88 and the distance between the bone crest and the contact point was 5 mm or less, complete interdental papilla fill was significantly associated with the tooth form or shape. Additionally, a higher gingival angle and increased gingival thickness demonstrated a strong correlation with the presence of healthy and well-formed papillae.

Various Causes of Loss of Interdental Papillae

Periodontitis and bone loss: The interdental papilla can be lost due to periodontitis, which results in interproximal bone loss. Treatment of periodontitis can lead to the formation of black triangles. This condition becomes more apparent in both non-surgical and surgical approaches-especially in pocket elimination or resective surgical procedures. Additionally, necrotizing periodontal diseases may also contribute to the formation of black triangles.

Iatrogenic factors: Tissue damage resulting from over-contoured restorations or improper crown preparations can cause the loss of the interdental papilla. Other factors, such as traumatic brushing habits, overuse of interdental aids, behaviors like chewing on pens, or gingival trauma from piercings, can also lead to papilla loss.

Tooth-related factors: Factors such as loss of contact points, misalignment of teeth, abnormal tooth shapes, triangular crowns, diastemas, divergent roots, and excessive eruption of teeth may also result in interdental papilla loss.

Orthodontic treatment: Orthodontic treatment is another factor that can lead to interdental papilla loss. Black triangles are reported to occur in 38% of adult patients after orthodontic treatment.[6]

Prevalence of black triangles post-orthodontic treatment: A systematic review conducted by Rashid et al.[7] examined the prevalence of black triangles following orthodontic treatment. This review, which included five studies, found that the prevalence of black triangles ranged from 38% to 58% after orthodontic treatment. The authors identified risk factors associated with black triangle formation as age, tooth-related features, treatment duration, and patient-related factors.

The classification of interdental papilla is essential for assessing the current condition and determining the prognosis. The height of the interdental papilla may vary in degrees of loss. Classification systems developed for this purpose provide a valuable guide for clinicians, enabling standardized care practices. These classifications serve as a foundation for diagnosis, prognosis determination, and treatment planning. Furthermore, they are crucial for ensuring data homogeneity and facilitating data integration for research purposes, such as systematic reviews and meta-analyses.

In 1998, Nordland and Tarnow[4] proposed a classification system based on three reference points to assess losses in interdental papilla height: the contact point, the buccal-apical extension of the cementoenamel junction (CEJ), and the interproximal CEJ. This classification is defined as follows:

Normal: The interdental papilla completely fills the embrasure space up to the apical portion of the interdental contact point/area.

Class I: The tip of the interdental papilla lies between the interdental contact point and the most coronal extension of the CEJ.

Class II: The tip of the interdental papilla is at or apical to the interdental CEJ but more coronal than the buccal CEJ's apical extension.

Class III: The tip of the interdental papilla is at or apical to the buccal CEJ's apical extension.

In 2004, Cardaropoli introduced a new classification system for evaluating interdental papilla height called the Papilla Presence Index (PPI). This system grades the presence of the interdental papilla using four distinct scores:

Score 1: The papilla is completely present.

Score 2: The papilla is partially lost, but the interdental CEJ is not visible.

Score 3: The papilla is completely absent, and the interdental CEJ is visible.

Score 4: The papilla is completely absent; both the buccal and interdental CEJ are visible.

The loss of the interdental papilla can result in the formation of black triangles, which are aesthetically unpleasing and may lead to food impaction and phonetic difficulties. These issues negatively impact the patient's oral health-related quality of life and self-esteem.[8] Due to its aesthetic impact, dentists frequently face requests to manage or reconstruct lost interdental papillae. Treatment options for papilla reconstruction can be surgical, non-surgical, or ortho-restorative in nature.[9] The flap was then closed with simple interrupted sutures along the incision line using 4.0 silk sutures. Bleeding was controlled at both donor and recipient sites, and moist gauze was applied to the area with pressure to aid hemostasis.

CASE

During anamnesis, a 43-year-old female patient with no systemic disease or medication history was found to have previously sought treatment for tooth #13, which had undergone root canal therapy. At the clinic she visited a year earlier, extraction was recommended, and implant placement was planned.

Following the extraction, hard and soft tissue healing was observed, and approximately three months later, dental implant surgery was performed in the region. During the osseointegration period, when a flap was raised to place the healing abutment, mobility of the implant was noted. The implant was removed, and the area was left to heal again. Two months later, a new dental implant was placed, and the healing process was monitored. At the end of the osseointegration period, successful healing was confirmed, and the prosthetic phase was initiated. However, during the preparation and follow-up of the prosthetic restoration, black triangular spaces due to papilla loss became evident. For aesthetic evaluation, the patient was referred to the periodontology clinic (**Figure 1**). During clinical examination, no signs of inflammation, such as bleeding on probing, redness, edema, or pus discharge, were observed in the peri-implant mucosa. Adequate keratinized tissue was also noted, and the probing depth was measured at 4 mm.

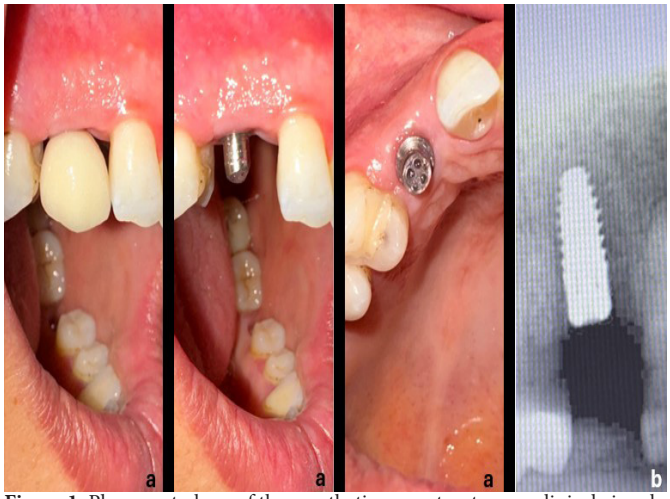

Figure 1. Placement phase of the prosthetic superstructure: a. clinical view, b. radiographic view

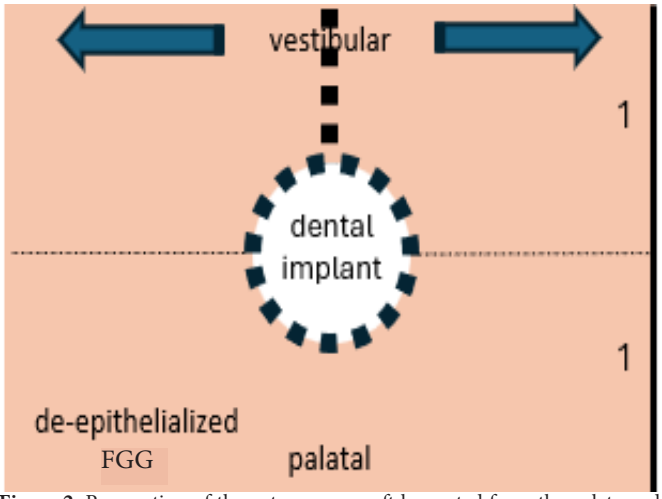

Figure 2. Preparation of the autogenous graft harvested from the palate and de-epithelialized before placement in the recipient site. A space was left on the graft for the abutment area, and the graft was incised into two equal parts on its vestibular half to provide volume in the mesial and distal papilla regions

The absence of a prosthetic restoration during the procedure guided the decision to prioritize graft stabilization. To reconstruct the papilla, it was decided to use a free gingival graft harvested from the palatal region on the same side, which would be de-epithelialized before placement.

Following routine surgical preparations, a soft tissue graft was harvested from the upper right quadrant. Under infiltrative anesthesia, a free gingival graft approximately 2 mm thick and wide enough to match the mesiodistal distance between teeth #12 and #14 was obtained from the palatal gingival contours, 2-3 mm away from the palatal surfaces of teeth #14 and #15. Once the graft was fully detached, the oral-cavity-facing portion was de-epithelialized. Hemostasis at the donor site was achieved, and a suspension suture was placed using 4.0 silk sutures (İpek Plastic Inc., İstanbul, Turkiye), secured to the adjacent teeth. At the recipient site, an incision was made from the distal-palatal point of tooth #12 to the mesial-palatal point of tooth #14 using a #15 blade without contacting the bone. The incision line continued intrasulcularly along the interdental surfaces of the adjacent teeth and extended into the vestibular area. A partial-thickness flap was raised, preparing the recipient site for graft placement. The graft was positioned in a way that did not interfere with the prosthetic restoration and extended into both papillary regions to fill the existing void. It was divided into two equal parts along the vestibular incision to address the papillae on both sides. The graft was stabilized to the underlying tissues with Vicryl sutures (Setpa Medical Equipment LTD. STI., İzmir, Turkiye), ensuring immobility (**Figure 2**). The flap was then closed primarily using simple interrupted sutures along the incision line with 4.0 silk sutures (İpek Plastic Inc., İstanbul, Turkiye). Bleeding was controlled at both the donor and recipient sites, and moist gauze was applied with pressure to maintain hemostasis.

Following the procedure, the patient was prescribed Bi-profenid 100 mg (Sanofi Pharmaceutical Industry and Trade Inc., Kırklareli, Turkiye) to be taken twice daily and Kloroben 1.5 mg/ml+1.2 mg/ml mouthwash (Drogsan Pharmaceuticals Industry and Trade Inc., Ankara, Turkiye) to be used twice daily. A follow-up appointment was scheduled for the 10th postoperative day. The 1-month follow-up image is shown in **Figure 2**. During the postoperative healing period, the recovery was uneventful. Sutures were removed on the 14th day. At the 1-month follow-up, the patient reported no complaints, and the surgical site was observed to have healed with appropriate closure. At the 3-month follow-up, a loss of mesial and distal papillae was observed, as shown in **Figure 3**. Radiographic evaluation revealed over 50% bone loss in the region. Clinical examination measured a probing depth of 9 mm with bleeding on probing. The patient was informed, and peri-implantitis treatment was initiated. No mobility, pus discharge, or pain complaints were reported (**Figure 4**).

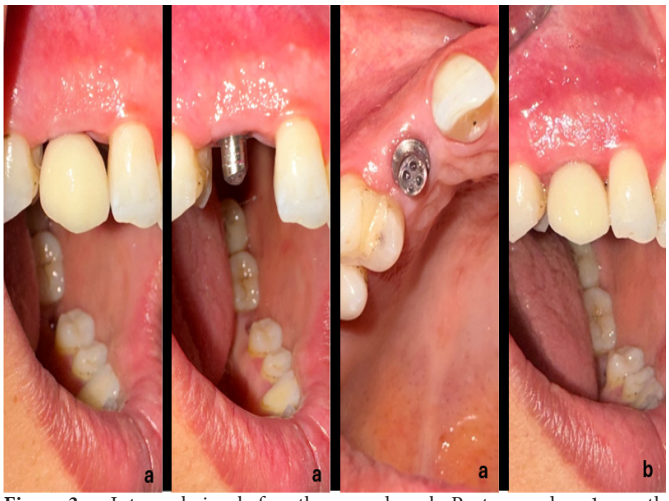

Figure 3. a. Intraoral view before the procedure, b. Post-procedure 1-month follow-up showing filling in the mesial and distal papilla regions

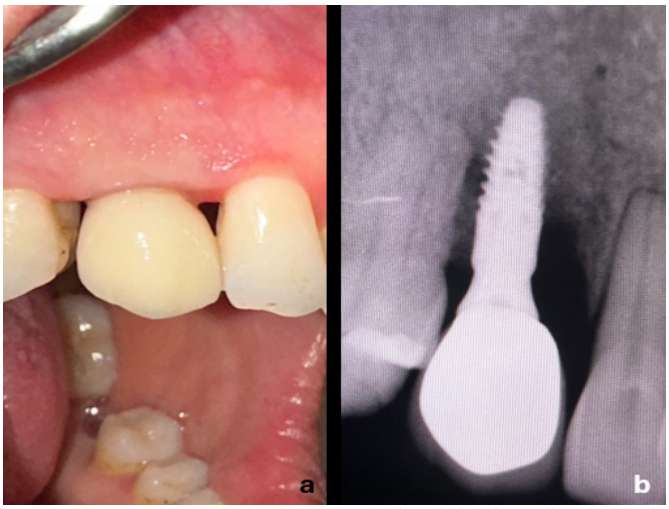

Figure 4. 3-month post-procedure: a. mesial and distal papilla regions, b. radiographic view

DISCUSSION

The height of the gingival papilla is influenced by various factors, including anatomical structures, the degree of inflammation, the distance from the interproximal bone crest to the contact point, and previous surgical or non-surgical treatment methods.[10] Among these factors, the most critical is the distance between the bone crest and the contact point. Tarnow and colleagues found that 98% of gingival papillae between natural teeth remained intact when the distance from the bone crest to the contact point was ≤5 mm. However, when this distance increased to 6 mm and ≥7 mm, the intact papilla rates dropped to 56% and 27%, respectively.[10,4] The findings from the follow-up in our study align with Tarnow et al.'s[4] results, demonstrating that an increase in probing depth reduces the amount of intact papillae. The lack of gingival papilla is a complex issue, both aesthetically and functionally.[11] According to the Jemt Papilla Index, gingival papilla defects are categorized into five levels based on their degree of fill: 0: No papilla is present. 1: Less than half of the papilla height is present. 2: Half or more of the papilla height is present. 3: The papilla fills the entire proximal space. 4: The papillae are hyperplastic. Loss of gingival papilla height leads to the formation of black triangles, which disrupt the aesthetics of the anterior teeth. Additionally, gingival papilla defects can cause food impaction and plaque accumulation, further compromising periodontal health. Numerous studies have explored the reconstruction of the gingival papilla. However, creating papillae in the esthetic zone remains challenging due to its complexity and the interplay of multiple factors.[12]

For papilla reconstruction, treatment options include the use of hyaluronic acid, platelet-rich fibrin (PRF), soft tissue grafts, and orthodontic treatment, encompassing both surgical and non-surgical approaches.[13] Surgical methods are typically invasive and may yield unpredictable results.[14,15] Although some non-surgical studies involving hyaluronic acid report favorable outcomes due to its biocompatibility and high patient satisfaction, repeated injections and the associated cost must be considered.[16] Additionally, in certain cases, a minimally invasive autologous approach has been applied using the interdental papilla reconstruction technique (i-PRT), enhanced with injectable platelet-rich fibrin (i-PRF). This method leverages autologous biological materials to support papilla reconstruction while minimizing invasiveness. Beagle described a technique involving a horizontal incision on the palatal side combined with two vertical incisions to separate a split-thickness flap. The gingival flap was then sutured and secured to the buccal side. Han and Takei,[17] pioneered the restoration of missing gingival papillae using a combination of crescent-shaped incisions and connective tissue grafts (CTG), achieving favorable surgical outcomes.[18]

CONCLUSION

The reconstruction of the gingival papilla is considered a challenging technique within the field of periodontal mucogingival surgery. This case report describes the use of autogenous de-epithelialized free gingival grafts for papilla reconstruction in a patient dissatisfied with the aesthetic outcome due to papilla loss, along with a 3-month follow-up. A thorough evaluation of clinical follow-ups and the patient's procedural history plays a crucial role in determining the prognosis of surgical interventions.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Cohen B. Pathology of the interdental tissues. *Dental Practit.* 1959;(9):167-173.
2. Prato GP, Rotundo R, Cortellini P, Tinti C, Azzi R. Interdental papilla management: a review and classification of the therapeutic approaches. *Int J Periodontics Restorative Dent.* 2004;24(3):246-255. doi:10.1016/J.PROSDENT.2004.07.002
3. Holmes CH. Morphology of the interdental papillae. *J Periodontol.* 1965;36(6):455-460. doi:10.1902/jop.1965.36.6.455
4. Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. *J Periodontol.* 1992;63(12):995-996. doi:10.1902/jop.1992.63.12.995
5. Joshi K, Baiju CS, Khashu H, Bansal S, Maheswari IB. Clinical assessment of interdental papilla competency parameters in the esthetic zone. *J Esthet Restor Dent.* 2017;29(4):270-275. doi:10.1111/jerd.12307
6. Kurth JR, Kokich VG. Open gingival embrasures after orthodontic treatment in adults: prevalence and etiology. *Am J Orthod Dentofacial Orthop.* 2001;120(2):116-123. doi:10.1067/mod.2001.114831
7. Rashid ZJ, Gul SS, Shaikh MS, Abdulkareem AA, Zafar MS. Incidence of gingival black triangles following treatment with fixed orthodontic appliance: a systematic review. *Healthcare (Basel).* 2022;10(8):1373. doi:10.3390/healthcare10081373
8. Pitale U, Pal PC, Thakare G, Verma M, Dhakad S, Pandey R. Minimally invasive therapy for reconstruction of lost interdental papilla by using injectable hyaluronic acid filler. *J Indian Soc Periodontol.* 2021;25(1):22-28. doi:10.4103/jisp.jisp_19_20
9. Matas Hennig MA, Marconato MJ, Musskopf ML. Absence of interdental papilla-systematic review of available therapeutic modalities. *Stomatos.* 2016;22(43):31-43.
10. Rasperini G, Tavelli L, Barootchi S, et al. Interproximal attachment gain: the challenge of periodontal regeneration. *J Periodontol.* 2021;92(7):931-946. doi:10.1002/JPER.20-0587
11. Jemt T. Regeneration of gingival papillae after single-implant treatment. *Int J Periodontics Restorative Dent.* 1997;17(4):326-333.
12. Han TJ, Takei HH. Progress in gingival papilla reconstruction. *Periodontol 2000.* 1996;11:65-68. doi:10.1111/j.1600-0757.1996.tb00184.x
13. Patel M, Guni A, Nibali L, Garcia-Sanchez R. Interdental papilla reconstruction: a systematic review. *Clin Oral Investigat.* 2024;28(1):101. doi:10.1007/s00784-023-05409-0
14. Prato GP, Rotundo R, Cortellini P, Tinti C, Azzi R. Interdental papilla management: a review and classification of the therapeutic approaches. *Int J Periodontics Restorative Dent.* 2004;24(3):246-255. doi:10.1016/J.PROSDENT.2004.07.002
15. Singh S, Vandana KL. Use of different concentrations of hyaluronic acid in interdental papillary deficiency treatment: a clinical study. *J Indian Soc Periodontol.* 2019;23(1):35-41. doi:10.4103/jisp.jisp_332_18
16. Abdelraouf SA, Dahab OA, Elbarbary A, El-Din AM, Mostafa B. Assessment of hyaluronic acid gel injection in the reconstruction of interdental papilla: a randomized clinical trial. *Open Access Maced J Med Sci.* 2019;7(11):1834-1840. doi:10.3889/oamjms.2019.478
17. Han TJ, Takei HH. Progress in gingival papilla reconstruction. *Periodontol 2000.* 1996;11:65-68. doi:10.1111/j.1600-0757.1996.tb00184.x
18. Beagle JR. Surgical reconstruction of the interdental papilla: case report. *Int J Periodontics Restorative Dent.* 1992;12(2):145-151.